

Last year, at DARPATech '99, I outlined for you a changing world. This year, I repeat: National Security threats continue their rapid change, the critical technologies necessary for Defense continue to be available globally, the rules of engagement for our military continue to be uncertain and we continue to operate with coalition partners. The DoD's increasing need for affordable technology continues.

The newly issued Joint Vision 2020 echoes these concerns, noting that it will be difficult for the U.S. to sustain a wide technological advantage over adversaries in all areas, given the globalization of technology. Joint Vision 2020 also mentions the likelihood that the U.S. will face asymmetric threats in the future.

More importantly, JV 2020 explains the importance of technological, organizational and conceptual innovation in National Security. It sees this innovation as vital to the transformation of the joint force of the future. I would like to quote for you a section of JV 2020 discussing innovation, so that you can see how important technologists such as yourselves will be to the future military.

“... the U.S. Armed Forces will continue to rely on a capacity for intellectual and technical innovation. The pace of technological change, especially as it fuels changes in the strategic environment, will place a premium on our ability to foster innovation in our people and organizations . . .”

I view this as a call to action for the U.S. technical community. DARPA will serve as the change leader for DoD. You, our performers, and your technical ideas, are crucial to DoD's ability to transform for the future.

That is how we chose the theme for this DARPATech – “Transformation through Technology Innovation.” Our mission is to enable radical innovation in support of National Security.

Let me talk to you a little bit about the characteristics of innovation. This repeats some things I told you last year. First of all, let me be clear. Innovation is much more than invention! Innovation is the process of using inventions, whether technical or operational or financial, to change the way we do business!

Innovation can generally be classified into two categories. Sustaining innovation, which refers to predictable, dependable advances in capability, is what is normally part of a long-term plan. On the other hand, revolutionary, radical innovation uses an enabler (technical or otherwise) and a new paradigm (business model) to achieve a level of performance that eventually far exceeds the limits of current, evolutionary advances.

Innovation takes a long time for large institutions. It requires iteration between new operational concepts and new technical ideas.

Radical innovation, in particular, is very risky. The new paradigm may not be obvious and almost always initially under-performs the current established business model. Failures are inevitable!

Radical innovation depends strongly on creative people and is therefore subject to their vulnerabilities and weaknesses.

Radical innovation almost always displaces or disrupts some well-established, current operation in the business. It is therefore a threat. As such, radical innovation must be protected since the operation it displaces will almost certainly attack and attempt to destroy it. As an example, the British invented naval aviation, and, before World War II, developed a lot of the tactics. But it was the United States and Japan that actually used aviation to change the way naval warfare was conducted. The British admiralty's long-standing battleship mentality did not allow them to exploit this new concept.

Finally, radical innovation requires leadership, dedication and high-level protection. In almost every case study, successful radical innovation has involved both high-level champions to support and protect it and, "green-eyed zealots" who, for their own reasons, choose to make this paradigm change the hallmark of their careers.

Defense innovation requires both radical innovation, and sustaining, requirements-based R&D in order to provide our Nation with the defense capability needed for the 21st century.

What difference can radical innovation make? DARPA was established in 1958 to guarantee that the U.S. had the defining difference in the way we conducted military operations. Over the years, we have provided technologies to give the U.S. "the edge" – high energy lasers, space vehicles, stealth aircraft, to name a few.

What is the next technical area that the U.S. military can use to get the edge? I believe that robotics integrated into the force will give the U.S. military the overwhelming edge it needs. Our investments in advanced, high-speed networks, complex system design and operation, wireless communications, microcircuits that combine information technologies and biological systems, and other areas, will enable the U.S. to conduct combined manned and unmanned military operations. Over the next two and a half days, you will hear talks about the areas in which we are investing to bring this vision to reality.

Providing the technical edge is the key to our involvement with the Army in developing Future Combat Systems. Our vision for FCS is revolutionary – a network-centric land warfare system of systems composed of manned and unmanned nodes. It will give the U.S. a capability that no other nation possesses.

Our Unmanned Combat Air Vehicle programs are another example. We are working jointly with the Air Force and the Navy to develop an autonomous unmanned system that will be able to work with manned aircraft to effectively and affordably suppress enemy air defenses.

Just think of it – the U.S. will be able to use an unmanned aircraft for dangerous operations rather than put pilots at risk. And this unmanned aircraft will operate autonomously within the rules of engagement, in association with manned aircraft to prosecute its mission. It

will not be fire and forget – humans will maintain command and control throughout the mission, and the vehicle will return to base to be used again. This will truly be a revolutionary capability.

Orbital Express is another step towards the future. In this program we are developing technologies to allow the autonomous rendezvous, refueling and repairing of satellites on-orbit. This will give us unprecedented abilities to upgrade our space-based assets.

In FCS for the land battle, and UCAVs to suppress enemy air defenses, we must innovate to determine the new operational paradigm in addition to the technology. Continuing to evolve improved capabilities based on today's mode of operations will not give the U.S. the defining edge that we seek. Only radical innovation, a new way of fighting conventional war will allow the U.S. to prevail. I hope that the talks that you will hear on both of these programs will make it clear to you the innovation necessary to succeed.

If it is DARPA's mission to guarantee technical options to future warfighters, then our support of innovative technologies is crucial. If we succeed, the rest of the world should be technically jealous of our accomplishments.

We choose our investment focus areas because we feel that these are the areas that will give the U.S. the technical edge over its adversaries. These are areas that will allow our military to differentiate itself from other militaries given the globalization of technology. The purpose of DARPA Tech is to explain to you our investment themes and program areas, and how we propose to provide the military with its technical edge.

Before I describe some of our investments, first let me acquaint you with our organization and how DARPA operates.

We have a very broad and eclectic charter, ranging from the development of prototype military systems to the most fundamental research. We have seven technical offices, each headed by a Director and Deputy Director and including 15 to 20 program managers.

The Advanced Technology Office manages programs for early entry, rapid reaction forces and Special Forces, and communications and maritime applications.

The Defense Sciences Office emphasizes biological warfare defense technologies, biological programs, materials efforts, and mathematics.

The Information Systems Office invests in systems for information assurance and security, command and control, and planning and logistics. They also lead our efforts to counter the emerging asymmetric threat.

The Information Technology Office emphasizes networking, embeddable systems, human computer interface, translingual and software composition technologies.

The Microsystems Technology Office manages electronics, photonics, MEMS and their integration into microsystems.

The Special Projects Office manages efforts for chemical and biological defense, surface and underground target engagement, and improved sensors and navigation.

The Tactical Technology Office develops advanced air, space and land platforms, advanced radar and laser technologies, future land combat systems, and space-based payloads.

Now let me go back to our investment areas. We group our investments into three main focus areas.

Our first concern is to find technical solutions to national-level problems. Our priority is on problems that may impact our national survival. At present, protection from biological attack and protection from information attack are such problems.

The Biological Warfare Defense effort is developing therapeutics countermeasures, advanced sensors, advanced diagnostics, consequence management tools, air and water purification devices, and genetic sequencing codes for potential biological threat agents. You will hear a talk on this area on Friday.

In the Information Assurance and Survivability programs we are developing technologies to raise strong barriers against cyber attack and provide commanders with mechanisms to see, counter, tolerate and survive sophisticated cyber attacks.

Our second mission is to be the technical enabler for the innovation required to achieve dominance across the range of military operations – what the military calls “operational dominance.”

In the area of Enabling Operational Dominance, DARPA is investing in technologies and systems for affordable, precision moving target kill for both offensive and defensive mission. We are investing in dynamic command and control capabilities for mobile networks. Near-real-time logistics planning and replanning is also of interest. Other programs will enable future warfare concepts for air, space, land and sea. The classification of hard and deeply buried targets is a particularly challenging new warfare concept of interest. These programs are pursued in four of our offices – the Advanced Technology Office, Information Systems Office, Tactical Technology Office and the Special Projects Office. You will hear more about programs in these areas throughout DARPA Tech.

Incidentally, let me encourage you to visit the exhibit area, where you’ll have a chance to interact with our program managers and learn more about our programs.

In our third mission area, we continue to develop and exploit high-risk core technologies reflecting DARPA’s traditional strengths. In this way, we can fulfill DARPA’s charter of “avoiding technological surprise.”

Our core technology investments include information technology, microsystems, materials, microelectromechanical systems, biology, mathematics and more.

In addition, one of DARPA's newest thrusts is the BioFutures effort, which aims to combine biology with DoD's traditional investments in information technologies, and microsystems.

The Beyond Silicon program is another new investment area that is investigating approaches and architectures for electronic device designs that extend beyond today's scaling of traditional complementary metal-oxide semiconductor (CMOS) devices.

Let me now move on to my management priorities. I discussed these with you last year, and they continue to be at the forefront of my strategy for DARPA. To refresh your memory, and for those who were not able to be with us last year, I stress the importance of attracting excellent people to work at DARPA. DARPA is small, and our project management activities are people-intensive. Our people will get exposed to important problem areas, will be given resources to fund good programs and the freedom to manage them. To be effective, I need a continuing supply of very special people drawn from the military, universities, government, and industry. My Human Resources Director, Nic Lanzetta, is here at the conference. If you think you may be interested in a tour at DARPA, please see Nic. He has information about working for the government and for DARPA.

I encourage you to consider coming to DARPA as a Program Manager. Talk to our Program Managers here at the conference. We need your ideas and enthusiasm! At DARPA, you can make a difference.

My second management priority is to foster an environment that allows researchers to compete fairly with each other. I want fair competition to determine the best ideas and the best technical approaches. I believe that if DARPA's management continues to encourage and reward professional respect and scrupulous ethics, DARPA will continue to be able to attract the best researchers to work on these programs.

I mentioned to you earlier the trend toward technological globalization. DARPA must avoid technological surprise from adversaries who take advantage of globally available technologies. I am therefore putting in place a methodical process to fully understand and appreciate the importance of externally generated events and to take timely action in response. I have established an on-going dialogue with the Chief Technology Officers of commercial companies in sectors affecting DoD. They come and discuss technical trends in their industries, so that DARPA and DoD can make the correct investment choices.

I continue to work closely with the Joint Staff, the Unified Commanders and the leadership of the Army, Navy, Air Force, and Marine Corps. Together we can use experimentation to evaluate DARPA's high-risk, high-return technologies, and focus our know-how on the Military Services' most critical future problems.

As an example, we and the Air Force are partnering for iterative experimentation at Nellis Air Force Base. We are focusing on innovative ways to locate and destroy mobile targets. We are providing the new technologies and technical experts, and the Air Force provides the platforms and their own experts. Together we are experimenting with new concepts of operation to provide exciting new capabilities to the Air Force.

We also have close relationships with the Army and the Navy.

I previously mentioned the Future Combat Systems demonstration program. This is key to the Army's future transformation efforts. We have an Army officer assigned to DARPA to lead the early phases of the program. He will transition to the Army with the program to shepherd it on into further development. These unique, personal relationships are crucial to successfully transitioning revolutionary technical capabilities quickly.

With the Navy, we have the Naval UCAV program as well as the Submarine Payloads and Sensors program. The senior Navy leadership recognizes the value of innovation in this time of rapid change. I look forward to continuing our productive collaboration on important Naval issues.

I hope that these close working relationships will help us transition DARPA technologies into the acquisition system more efficiently, so that we can get new capabilities into the hands of our warfighters.

I know that we have a number of Military officers attending DARPATech. I hope that you find our discussions interesting. You will hear briefs about some innovative ideas we have for revolutionary new military operations. We look forward to working with you to bring these ideas into fruition!

In closing let me say that I believe that for a variety of reasons we are entering a time when the leadership of well-trained technical people will be more important than ever in charting our National Security future. A true collaboration between warfighting and technology professionals is needed to assure our success in this journey. This is a change from the technology-driven sixties and the requirements-driven eighties. It is, indeed, the beginning of a long-term partnership based on the realization that both communities can gain from this union what they have learned they cannot achieve by themselves!

Thank you all for coming to DARPATech. I think that we've put together an interesting two and a half days for you. I'm excited about this year's program. I hope that you find that it stimulates further discussion and interaction.

Take advantage of the breaks to meet my Program Managers – they want to hear your ideas. Program Managers will be in the general session, others will be in the exhibit area and available for sidebar discussions. We look forward to meeting you.

Welcome to DARPATech 2000!

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